

WHAT IS CLAIMED IS:

1                   1.     A communication network comprising:  
2                   a plurality of network elements coupled together to communicate information  
3 across the network;  
4                   a management station coupled to a first network element in the plurality of  
5 network elements;  
6                   a plurality of network element subsystems in each network element, at least  
7 one of the plurality of network element subsystems generating a subsystem alarm in response  
8 to a subsystem fault condition; and  
9                   a distributed network operating system including at least one subsystem  
10 application on each network element for generating an application alarm in response to  
11 receiving the subsystem alarm,  
12                   wherein the management station signals the distributed network operating  
13 system to transmit application alarms and subsystem alarms from each network element,  
14 across the network to the first network element, and to the management station for display to  
15 a user.

1                   2.     The communication network of claim 1 wherein the distributed  
2 network operating system further includes executable code for associating text,  
3 corresponding to the subsystem fault condition, with the application alarm, and wherein the  
4 associated text is transmitted to the management station with the application alarms and  
5 subsystem alarms.

1                   3.     The communication network of claim 1 wherein a first subsystem  
2 application on each network element includes application code for generating a first  
3 application alarm in response to receiving a second application alarm from a second  
4 subsystem application.

1                   4.     The communication network of claim 1 wherein the subsystem alarm  
2 is generated on a first network element subsystem, and the at least one subsystem application  
3 is executable on the first network element subsystem.

1                   5.     The communication network of claim 1 wherein the subsystem alarm  
2 is generated on a first network element subsystem, and the at least one subsystem application  
3 is executable on a second network element subsystem.

1                   6.     The communication network of claim 1 wherein the network is an  
2 optical network and the plurality of network elements are coupled together using optical  
3 fibers.

1                   7.     The communication network of claim 6 wherein the application  
2 alarms, subsystem alarms, and associated text are transmitted across the network over a  
3 network optical supervisory channel in response to the management station signals.

1                   8.     The communication network of claim 6 wherein the distributed  
2 network operating system includes a power management application on each network  
3 element for calculating optical power levels in the optical network, and wherein the power  
4 management application generates a power management application alarm in response to the  
5 subsystem alarm.

1                   9.     The communication network of claim 8 wherein the subsystem alarm  
2 is generated on a first network element subsystem, and the power management application is  
3 executable on the first network element subsystem.

1                   10.    The communication network of claim 9 wherein the first network  
2 element subsystem is for signaling between network elements, and the subsystem alarm is in  
3 response to a signaling fault condition.

1                   11.    The communication network of claim 8 wherein the distributed  
2 network operating system includes a wavelength management application on each network  
3 element for managing optical power levels in the optical network, and wherein the  
4 wavelength management application generates a wavelength management application alarm  
5 in response to the power management application alarm.

1                   12.    The communication network of claim 6 wherein the distributed  
2 network operating system includes a wavelength management application on each network  
3 element for managing optical power levels in the optical network, wherein the wavelength  
4 management application is executable on a first subsystem for signaling between network  
5 elements, and wherein the wavelength management application generates a wavelength  
6 management application alarm in response to a hardware fault condition in the first  
7 subsystem.

1           13.     The communication network of claim 6 wherein the network is a ring  
2 network and the distributed network operating system includes a ring switching application  
3 on each network element for controlling a ring switching subsystem for re-routing optical  
4 signals in response to span failures, wherein the ring switching application generates a ring  
5 switching application alarm in response to a hardware fault condition in the ring switching  
6 subsystem.

1           14.     The communication network of claim 6 wherein the network is a  
2 UPSR network and the distributed network operating system includes a UPSR application on  
3 each network element for controlling path switching in response to faults in a primary traffic  
4 path, wherein the UPSR application generates a UPSR application alarm in response to a  
5 hardware fault condition in an optical power generator subsystem.

1           15.     A method of troubleshooting a plurality of network elements in a  
2 network under control of a distributed network operating system, each network element  
3 including a plurality of network element subsystems, the method comprising:

4                 generating a subsystem alarm for at least one of the plurality of network  
5 element subsystems in response to a corresponding subsystem fault;

6                 generating an application alarm in a subsystem application in response to the  
7 subsystem alarm;

8                 associating text with the application alarm, the associated text describing the  
9 subsystem fault; and

10                transmitting the subsystem alarm, the application alarm, and the associated  
11 text across the network to a management station coupled to one of the network elements for  
12 display to a user.

1           16.     The method of claim 15 wherein the subsystem alarm is generated on a  
2 first network element subsystem, and the application alarm is generated in a subsystem  
3 application that is executable on a second network element subsystem in response to a fault  
4 on the first network element subsystem.

1           17.     The method of claim 15 wherein the subsystem alarm is generated on a  
2 first network element subsystem, and the application alarm is generated in a subsystem  
3 application that is executable on the first network element subsystem in response to a fault on  
4 the first network element subsystem.

1           18.    The method of claim 15 wherein a first subsystem application on each  
2 network element includes application code for generating a first application alarm in response  
3 to receiving a second application alarm from a second subsystem application.

1           19.    The method of claim 15 wherein the network is an optical network and  
2 the plurality of network elements are coupled together using optical fibers.

1           20.    A method of troubleshooting an optical network comprising:  
2           under control of a distributed network operating system,  
3                 generating one or more subsystem alarms corresponding to subsystem  
4 fault conditions on at least one of a plurality of network elements in the optical  
5 network;  
6                 generating at least one application alarm when the one or more  
7 subsystem alarms satisfy a corresponding at least one application alarm condition;  
8                 associating at least one text element with the at least one application  
9 alarm;  
10                transmitting the one or more subsystem alarms, the at least one  
11 application alarm, and the at least one text element across said optical network to a  
12 first network element in the plurality of network elements; and  
13                transmitting the one or more subsystem alarms, the at least one  
14 application alarm, and the at least one text element to a management station coupled  
15 to the first network element, and  
16           under control of a management station, displaying the one or more subsystem  
17 alarms, the at least one application alarm, and the at least one text element to a user.

1           21.    The method of claim 20 wherein the one or more subsystem alarms,  
2 the at least one application alarm, and the at least one text element are transmitted across the  
3 network over a network optical supervisory channel in response to the management station  
4 signals.

1           22.    The method of claim 20 wherein the distributed network operating  
2 system includes a power management application on each network element for calculating  
optical power levels in the optical network, and wherein th

1           23.     The method of claim 22 wherein the first subsystem alarm is generated  
2 on a first network element subsystem, and the power management application is executable  
3 on the first network element subsystem.

1           24.     The method of claim 23 wherein the first network element subsystem  
2 is for signaling between network elements, and the first subsystem alarm is in response to a  
3 signaling fault condition.

1           25.     The method of claim 20 wherein the distributed network operating  
2 system includes a wavelength management application on each network element for  
3 managing optical power levels in the optical network, wherein the wavelength management  
4 application is executable on a first subsystem for signaling between network elements, and  
5 wherein the wavelength management application generates a wavelength management  
6 application alarm in response to a hardware fault condition in the first subsystem.

1           26.     The method of claim 20 wherein the network is a ring network and the  
2 distributed network operating system includes a ring switching application on each network  
3 element for controlling a ring switching subsystem for re-routing optical signals in response  
4 to span failures, wherein the ring switching application generates a ring switching application  
5 alarm in response to a hardware fault condition in the ring switching subsystem.

1           27.     The method of claim 20 wherein the network is a UPSR network and  
2 the distributed network operating system includes a UPSR application on each network  
3 element for controlling path switching in response to faults in a primary traffic path, wherein  
4 the UPSR application generates a UPSR application alarm in response to a hardware fault  
5 condition in an optical power generator subsystem.

1           28.     A program storage device readable by a machine, tangibly embodying  
2 a program of instructions executable by the machine to perform method steps for  
3 troubleshooting a network, said method steps comprising:

4                 generating a subsystem alarm for at least one of the plurality of network  
5 element subsystems in response to a corresponding subsystem fault;

6                 generating an application alarm in a subsystem application in response to the  
7 subsystem alarm;

8 associating text with the application alarm, the associated text describing the  
9 subsystem fault; and  
10 transmitting the subsystem alarm, the application alarm, and the associated  
11 text across the network to a management station coupled to one of the network elements for  
12 display to a user.